LIGHT-EMITTING DEVICE

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Abstract

PROBLEM TO BE SOLVED: To provide a light-emitting device excellent in uniformity for bright luminance.
SOLUTION: A light-emitting device is provided which comprises, at least, a light guide comprising facing first and second surfaces, a reflector provided to the second main surface of the light guide, and a light source so provided as to face on one end surface of the light guide, with the light from the light source emitted from the first main surface of the light guide. The light guide comprises a plurality of notches, different in shape from each other, on one end surface facing the emerging surface of a light-emitting part of the light source. The plurality of notches comprise a first surface where an angle from one end surface of the light guide becomes larger as comes away from the center of a surface facing the light emerging surface of the light emitting part, and a second surface where the angle from one end surface of the light guide becomes smaller as comes away from the center of the surface facing the light emerging surface of the light-emitting part.

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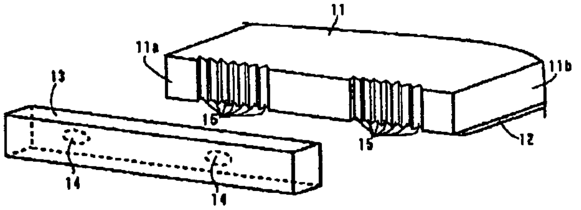
(54)【発明の名称】　発光装置

(57)【要約】

【課題】　均一性に優れ、高輝度発光可能な発光装置を提供することである。

【解決手段】　少なくとも対向する第１の主面及び第２の主面を有する導光体と、該導光体の第２の主面に設けられた反射体と、前記導光体の一端面に対向配置された光源とを備え、該光源からの光を前記導光体の第１の主面から出射させる発光装置において、前記導光体は、前記光源の発光部の出射面と対向する一端面に、互いに異なる形状の複数の切り欠きを有すると共に、該複数の切り欠きはそれぞれ前記発光部の出射面と対向する面の中央から遠ざかるにしたがって前記導光体の一端面とのなす角度が大きくなる第１の面と、発光部の出射面と対向する面の中央から遠ざかるにしたがって前記導光体の一端面とのなす角度が小さくなる第２の面とを有する発光装置。



【特許請求の範囲】

【請求項１】　少なくとも対向する第１の主面及び第２の主面を有する導光体と、該導光体の第２の主面に設けられた反射体と、前記導光体の一端面に対向配置された光源とを備え、該光源からの光を前記導光体の第１の主面から出射させる発光装置において、

前記導光体は、前記光源の発光部の出射面と対向する一端面に、互いに異なる形状の複数の切り欠きを有すると共に、該複数の切り欠きはそれぞれ前記発光部の出射面と対向する面の中央から遠ざかるにしたがって前記導光体の一端面とのなす角度が大きくなる第１の面と、発光部の出射面と対向する面の中央から遠ざかるにしたがって前記導光体の一端面とのなす角度が小さくなる第２の面とを有することを特徴とする発光装置。

【請求項２】　少なくとも対向する第１の主面及び第２の主面を有する導光体と、該導光体の第２の主面に設けられた反射体と、前記導光体の一端面に対向配置された光源とを備え、該光源からの光を前記導光体の第１の主面から出射させる発光装置において、

前記導光体は、前記光源の発光部の出射面と対向する一端面に、発光部の中心から遠ざかるにつれて角度の異なる面を有する切り欠きを複数有することを特徴とする発光装置。

【請求項３】　前記切り欠きは、隣接する切り欠きが平面を介して互いに離れている請求項１または請求項２記載の発光装置。

【請求項４】　前記光源は、半導体素子と、該半導体素子からの光を吸収しその吸収した光よりも長波長の光が発光可能な蛍光物質とを備えている請求項１乃至請求項３記載の発光装置。

【請求項５】　前記光源は、前記半導体素子が発生する光と前記蛍光物質が発生する光との混色による白色光を前記第１の主面から出射する請求項１乃至請求項３記載の発光装置。

【請求項６】　前記半導体素子は窒化物半導体素子であり、前記蛍光物質はＣｅで付活されたＹ２Ｏ３・５／３Ａｌ２Ｏ３蛍光体、Ｅｕ及び／またはＣｒで付活された窒素含有ＣａＯ－Ａｌ２Ｏ３－ＳｉＯ２蛍光体から選択される１種である請求項４または請求項５記載の発光装置。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は、点光源であるＬＥＤ素子から入射される導光体の発光面で均一に発光させることが可能で、液晶バックライト、パネルメーター、表示灯や面発光スイッチなどに用いられる発光装置に関する。

【０００２】

【従来技術】近年、液晶バックライトなどの光源として、点光源であるＬＥＤ素子からの光を面状に発光させる発光装置が用いられている。この発光装置は、導光板の光入射端面から発光ダイオードからの光を入射しその導光板の上面全体から光を出射させるように構成される。この発光装置においては、その上面（光出射面）から均一に光を出力することが重要であり、この均一性を実現するために種々の構造が提案されている。このような発光装置の一例を、図７の模式的平面図に示す。図７の発光装置は、透過性樹脂からなる導光板７１と、その導光板の光入射端面に対向配置されたＬＥＤ素子７４と、導光板の上面側から光を放出させるように、光放射面及び光入射端面を除いた側面及び下面に設けられた反射板（図示せず）とを有している。

【０００３】この図７の発光装置では、導光板の光入射端面に半円柱形状の切り欠き７５を形成することにより、導光板の上面に平行な方向に均一に光が分散して入射されるように構成し、これによりＬＥＤ素子から入射された光が上面から出射される面発光の均一化を図っている。

【０００４】

【発明が解決しようとする課題】しかしながら、より均一、高輝度発光が求められる現在においては充分ではない。特に点光源としてより発光輝度の高い発光素子（ＬＥＤ素子）を用いた場合は、上述の構成だけでは面発光の均一化と高輝度化とはトレードオフの関係にあり両立させるのは難しいという問題があった。そこで、本発明は、上記の問題を解決して、より均一性に優れ、高輝度発光が可能な発光装置を提供することを目的とする。

【０００５】

【課題を解決するための手段】本発明者らは種々の実験の結果、導光体の一端面に特定の形状の切り欠きを形成することにより、導光体の一端面から入射する光を導光体内により広く拡散させて、発光面からより均一でかつ高輝度に発光させることが可能なことを見いだし、本発明を成すに至った。

【０００６】すなわち本発明の発光装置は、少なくとも対向する第１の主面及び第２の主面を有する導光体と、導光体の第２の主面に設けられた反射体と、導光体の一端面に対向配置された光源とを備え、光源からの光を導光体の第１の主面から出射させる発光装置において、導光体は、光源の発光部の出射面と対向する一端面に互いに異なる形状の複数の切り欠きを有すると共に、複数の切り欠きはそれぞれ発光部の出射面と対向する面の中央から遠ざかるにしたがって導光体の一端面とのなす角度が大きくなる第１の面と、発光部の出射面と対向する面の中央から遠ざかるにしたがって導光体の一端面とのなす角度が小さくなる第２の面とを有することを特徴とする。これにより、導光体の一端面に形成された切り欠きを通して光源から入射する光を切り欠きの第２の面及び第１の面の角度に応じた方向に屈折させることができるので、より広い方向に光を拡散させて均一でかつ高輝度

な面発光をさせることができる。

【０００７】また、本発明の発光装置は、少なくとも対向する第１の主面及び第２の主面を有する導光体と、導光体の第２の主面に設けられた反射体と、導光体の一端面に対向配置された光源とを備え、光源からの光を導光体の第１の主面から出射させる発光装置において、導光体は、光源の発光部の出射面と対向する一端面に、発光部の中心から遠ざかるにつれて角度の異なる面を有する複数の切り欠きを有することを特徴とする。これにより、発光部からの光を切り欠きを構成する面の角度に応じた方向に光を屈折させることができる。

【０００８】また本発明において切り欠きは、隣接する切り欠きが平面を介して互いに離れて形成させることもできる。このようにすると切り欠き間に平坦面を形成させることができる。これにより光入射端面に入射する光のうち、切り欠きを構成する第１の面及び第２の面から入射される光を横方向に屈折して拡散させ、平坦面から入射される光を入射端面の垂直方向に伝搬させることができるので、比較的長い形状（例えば光入射端面が短辺となる長方形）の導光体を用いる発光装置において、均一でかつ高輝度な面発光をさせることができる。

【０００９】また本発明において光源は、半導体素子と、半導体素子からの光を吸収しその吸収した光よりも長波長の光が発光可能な蛍光物質とを備えたＬＥＤ素子を用いることができる。これにより、半導体素子と蛍光物質との組み合わせによって任意の波長の光を面状に出射させることができ、上述の光入射端面の切り欠きにより混色性（発光色の均一性）の優れた面発光を得ることができる。

【００１０】また本発明において光源は、半導体素子が発生する光と蛍光物質が発生する光との混色による白色光を導光体の第１の主面から出射させるように構成することができる。これにより、液晶バックライト等に好適な均一で高輝度な白色系面発光を得ることができる。

【００１１】また本発明の発光装置において、半導体素子を窒化物半導体素子とし、蛍光物質をＣｅで付活されたＹ２Ｏ３・５／３Ａｌ２Ｏ３、Ｅｕ及び／またはＣｒで付活された窒素含有ＣａＯ－Ａｌ２Ｏ３－ＳｉＯ２から選択される蛍光体とすることができる。これにより、簡便で高輝度に信頼性の高い混色発光可能な発光装置とすることができる。

【００１２】

【発明の実施の形態】本発明の発光装置は、光源から放出された光を導光体に導入して面状に発光させるものである。本発光装置は、その用途や目的に応じて使用する導光体の形状を選択することができ、例えば、パソコン等の液晶のバックライトに用いる場合は、略矩形の平板状の導光体が用いられ、また、自動車のパネルメーターのバックライト等に用いる場合は、そのデザインに応じた形状の導光体が用いられる。以下、図面を参照しながら、本発明に係る実施の形態の発光装置について説明する。

【００１３】本発明の実施の形態の発光装置は、図１、図２に示すように、少なくとも対向する第１の主面及び第２の主面を有する導光体１１と、導光体の第２の主面に設けられた反射体１２と、導光体の一端面と対向配置された光源１４とを備えている。光源の発光部の出射面から放出された光は、導光体の一端面である光入射端面１１ａから導光体内に導入された後、発光面である第１の主面から面発光される。

【００１４】ここで、特に本実施の形態の発光装置の導光体１１は、光源１４の発光部の出射面と対向する光入射端面１１ａに互いに異なる形状の複数の切り欠き１５を有している。この複数の切り欠き１５は、それぞれ発光部の出射面と対向する面の中央から遠ざかるにしたがって前記導光体の光入射端面とのなす角度が大きくなる第１の面１５ａと、発光部の出射面と対向する面の中央から遠ざかるにしたがって前記導光体の光入射端面とのなす角度が小さくなる第２の面１５ｂとを有することを特徴とし、これにより導光体の発光面から見て光入射端面近傍の輝度のムラを抑制して均一でかつ高輝度の面発光をさせることができる。

【００１５】詳細に説明すると、本実施の形態の発光装置において、光源１４は例えば樹脂形成体からなる支持体とその側面に形成された凹部に配された２つのＬＥＤ素子１３からなる。このＬＥＤ素子１３は、リード電極を有する樹脂パッケージの凹部に半導体素子を配し蛍光体を含む透光性樹脂によってモールドされているものであり、図２に示すようにその出射面が平坦になるようにモールドされる。

【００１６】本実施の形態において導光体１１は、透光性樹脂を用いて例えば射出成形によって略矩形の平板状に成形されており、光源１４と対向する光入射端面には図１及び図２に示すように光入射端面の長手方向に沿って複数の切り欠き１５が形成されている。光源１４は２つのＬＥＤ素子１３を備えており、切り欠きはＬＥＤ素子１３の発光部の幅とほぼ同じの幅の領域にそれぞれ複数形成されている。本実施の形態において、１つの切り欠きは第１の主面から第２の主面にほぼ垂直に達する２つの側壁から構成された三角柱状の形状である。ここで切り欠きを構成する２つの側壁のうち発光部の出射面と対向する領域の中央から遠い側の側壁を第１の面１５ａとし、中央に近い側の側壁を第２の面１５ｂとする。各切り欠きの幅及びその最深部１５ｃ（光入射端面を基準として最も深く切り込んだ部分）の深さ１５ｄ（光入射端面１４と最深部１５ｃとの距離）はほぼ同じであるが、最深部１５ｃの位置が異なるように形成されている。１つの切り欠きの幅は、ＬＥＤ素子の幅の３分の１より小さいのが好ましく、金型等の精度に応じて可能な範囲で小さく形成させるのが好ましい。また、１つの切

り欠きの深さは任意の深さとすることができるが、あまり深すぎると光源からの光が導光体に達するまでに厚い空気層が設けられることになり光が損失し易くなり、また発光装置の形態によっては有効発光面積が狭くなる等の問題が起こる場合もあるのでこれらを考慮する必要がある。

【００１７】また、発光部の出射面と対向する領域に形成された複数の切り欠きのうち中央に位置する切り欠きは、最深部１５ｃは切り欠きの幅の中心にくるように形成されているので発光面から見ると二等辺三角形になる。すなわち第１の面と光入射端面とのなす角度は第２の面と光入射端面とのなす角度は等しい。その他の切り欠きはそれぞれ発光部の出射面の中央から離れるにしたがって、その離れる方向に最深部１５ｃがずれるように形成される。こうすることにより切り欠きを構成している第１の面及び第２の面と光入射端面とのなす角度をそれぞれ光入射端面に対して大きくまたは小さくなるように変化させている。なお、すべての切り欠きの形状がそれぞれ異ならなくてもよく、例えば７つ並んだ切り欠きのうち中央の３つが同じ形状で、両端の２つは中央の３つとは形状が異なるというように形成されてもよい。発光部と対向する切り欠きが偶数個の場合は、二等辺三角形状の切り欠きを形成させなくてもよく、発光部の中央からの位置によって切り欠きの側壁の角度を上記と同様に変化させる。

【００１８】以上のように構成された本実施の形態の発光装置においては、導光体の光入射端面に形状の異なる切り欠きが複数形成されているので、以下のような作用効果を有する。すなわち、光源１４から出射された光は、導光体１１の光入射端面１１ａに形成された第１の主面から第２の主面にほぼ垂直に達する２つの側壁（第１の面１５ａ及び第２の面１５ｂ）を有する切り欠き１５に入射される。切り欠きに入射された光は上記の２つの面を通して導光体内に導入され、その側壁の角度に応じた角度で屈折または反射される。例えば光源からの光のうち直接第１の面１５ａに入射する光は、第１の面１５ａに対して全反射角より小さい入射角（光の進行方向と面の法線とのなす角度）で入射した場合はその入射角に応じた屈折角で導光体内に入射される。また、全反射角よりも大きい入射角で第１の面１５ａに入射する光は導光体内に導入されずに第２の面１５ｂに向けて反射される。第１の面１５ａから第２の面１５ｂに向けて反射された光のうち全反射角より小さい入射角で入射する光は第２の面１５ｂから導光体内に導入される。また、光源からの光が第２の面１５ｂに直接入射する場合も上記と同様に側壁に対する入射角に応じて反射または屈折される。ここで、光源と切り欠きとの位置関係が同じであるが形状が異なる（すなわち側壁と光入射端面とのなす角度が異なる）三角柱状の切り欠きに光が入射する場合の屈折を図３（ａ）及び（ｂ）に示す。光が入射する第１の面３５ａと光入射端面３１ａとのなす角度が図３（ａ）に比べて大きい図３（ｂ）の場合、図３（ａ）に比べてより横方向（ここでは導光体の側面に向かう方向）に光が屈折していることがわかる。これは、光源から同じ角度に光が出射されても、側壁の角度が変わることで入射角が変わるため屈折角度も変わるためである。これにより光を図３（ｂ）のように屈折させることができるので、光源間や導光体の隅部等の発光輝度の低い部分にも光が伝搬させることができ、均一でかつ高輝度の面発光を得ることができる。また、切り欠きを構成する第１の面３５ａ及び第２の面３５ｂが平面であることで、例えば同じ幅と深さの円柱状の切り欠き（側壁が曲面）と比べて、光源と側壁との間の距離が短くなり空気層を減らすことができるので光の損失を少なくすることができる。

【００１９】（変形例１）次に、本発明の変形例について説明する。本発明に係る変形例２の発光装置は、図４に示すように、第１の面４１５ａ及び第２の面４１５ｂの間に第３の面４１５ｅを有する切り欠き４１５が複数形成される以外は、実施の形態と同様に構成される。各切り欠きの第１の面及び第２の面と光入射端面とのなす角度は実施の形態と同様に変化させてあるので、光源からの光は実施の形態と同様に横方向に広く拡散される。第３の面４１５ｅ（あるいはこれに第４の面等を加えてもよい）の角度及び幅等は任意とすることができ、また、切り欠きすべてに設けなくともよい。この第３の面は第１の面及び第２の面に比べてを光入射端面となす角度は小さいので、光入射端面から遠い方向への光の配分を多くすることができる。

【００２０】（変形例２）本発明に係る変形例２の発光装置は、図５に示すように、第１の面５１５ａと第２の面５１５ｂの間に曲面５１５ｆを有する切り欠き５１５が複数形成される以外は、実施の形態と同様に構成される。各切り欠きの第１の面及び第２の面と光入射端面とのなす角度は実施の形態と同様に変化させてあるので、光源からの光は実施の形態と同様に横方向に広く拡散される。切り欠き構成する第１の面と第２の面とが曲面５１５ｆを介して接していることで、切り欠きの幅が狭く最深部の幅が細くなる場合の金型からの取り出しを容易にできる。

【００２１】（変形例３）本発明に係る変形例３の発光装置は、図６に示すように、三角柱状の切り欠き６１５が互いに離れて形成されている以外は、実施の形態の発光装置と同様に構成される。各々の切り欠き６１５の形状は、実施の形態のように変化させることができる。隣接する切り欠き６１５が離れて形成されることで、光入射端面には光源からの出射光に対して垂直な面（平坦部）６１１ｇと出射光に対して傾斜を有する面６１５ａ及び６１５ｂが形成されることになる。切り欠き６１５の側壁６１５ａ及び６１５ｂは光を屈折して横方向に広

く拡散できるが、平坦部６１１ｇは入射光を横方向に屈折させずに光入射端面の反対側に向けて光を伝搬させることができる。このように構成することで、導光体が比較的長い形状（光入射端面を短辺とする長方形）を用いた発光装置のような場合に、光入射端面から遠い部分にまで光を伝搬させることができ、より均一な輝度の面発光が得られる。この切り欠き６１５と平坦面６１１ｇとの割合（発光部の出射面と対向する領域における割合）は、導光板の形状や大きさにもよるが、面積にして１：２〜２：１程度が好ましい。また、各切り欠きはすべて離れて形成されていなくてもよく、そのうちのいくつかは接して形成されていてもよい。

【００２２】以上実施の形態により説明したように、本発明の発光装置は、導光体の光入射端面に形状の異なる切り欠きを複数形成し、かつその形成される位置に応じて切り欠きを構成する２つの面と光入射端面とのなす角度を変化させることで入射光を導光体内により広く拡散させることができるので、発光のムラを抑制し、高輝度の面発光を得ることができる。

【００２３】本発明の発光装置は上述のように、切り欠きの形状を導光体の形状に応じて最も適切な形状を選択して、より効果的に入射光を拡散できるように構成できる。この場合、切り欠きの数を増やして側壁を増やすと光をより複雑に拡散させることができ、輝度の均一を向上させることができるが、金型構造が複雑となり、その結果その金型により作製される導光体の端面の形状が一定しなくなる等の問題も生じることがある。そのため、使用目的による要求仕様に加え、製造条件も考慮して用いる形状を選択することが好ましい。

【００２４】すなわち、本発明では種々の形状を選択することができるので、どの形状の切り欠きを選択するかは、目標とする性能、金型の製作上の制約（製作精度及び製造コスト）及び成型精度等を総合的に検討して決定することができる。

【００２５】以下、本発明に係る発光装置における各要素に関する好ましい材料等について説明する。

（導光体）本発明において導光体に用いられる材料としては、光透過性、成形性に優れたものを用いることが好ましく、アクリル樹脂、ポリカーボネート樹脂、シクロオレフィンポリマー、ポリスチレン樹脂、ファンクショナルノルボルネン系樹脂等が挙げられる。これらの導光体用の材料はそれぞれ屈折率が異なるが、導光体の光入射端面に形成する切り欠きの角度や数等を選定することによって、光の拡散を制御することができるので、如何なる屈折率の材料にも対応できる。導光体の形状は、用途に応じて任意の形状とすることができる。

【００２６】（光源）本発明の発光装置において、光源は１または２以上のＬＥＤ素子を備えており、ＬＥＤ素子と導光板の一端面に形成した切り欠きとが対向配置させるよう位置決めして固定させるために、例えば樹脂成形体からなる支持体にＬＥＤ素子の光出射面が導光体の光入射端面と対向するように配置させて構成される。ＬＥＤ素子は、半導体素子と、これを被覆する透光性樹脂とを有しており、透光性樹脂は半導体素子から発生する光を吸収してその吸収した光とは異なる波長の光を発生する蛍光体を含有させることができる。半導体素子から発生する光が紫外線の場合は、この紫外線によって励起されて紫外線または可視光を発生する蛍光体を用いることができるし、あるいは、可視光の発光が可能な半導体素子と、この半導体素子からの可視光を吸収してそれよりも長波長の可視光が発光可能な蛍光物質とを組み合わせてもよい。すなわち、本発明において、半導体素子を蛍光体と組み合わせて用いることにより、様々な色調の混合色を発光させることが可能である。さらに上述の切り欠きから光を入射させることで、混色性も良くすることができる。

【００２７】（半導体素子）ここで用いることができる、半導体素子としては窒化物系化合物半導体（一般式ＩｎｉＧａｊＡｌｋＮ、但し、０≦ｉ、０≦ｊ、０≦ｋ、ｉ＋ｊ＋ｋ＝１）が挙げられ、ＩｎＧａＮや各種不純物がドープされたＧａＮをはじめ、種々のものがある。この半導体素子は、ＭＯＣＶＤ法等により基板上にＩｎＧａＮやＧａＮ等の半導体を発光層として成長させることにより形成する。半導体の構造としては、ＭＩＳ接合、ＰＩＮ接合やｐｎ接合などを有すホモ構造、ヘテロ構造あるいはダブルヘテロ構造のものが挙げられる。この窒化物半導体層は、その材料やその混晶度によって発光波長を種々選択することができる。また、半導体活性層を量子効果が生ずる薄膜で形成した単一量子井戸構造や多量子井戸構造とすることもできる。

【００２８】（蛍光体）本発明の発光装置に用いる蛍光体の例としては、可視光や紫外線で励起されて発光するフォトルミネッセンス蛍光体がある。具体的フォトルミネッセンス蛍光体例としては、窒化物系化合物半導体素子からの青色系発光により黄色系が発光可能な蛍光体であるＹＡＧ：ＣｅなどのＹＡＧ（Ｙ２Ｏ３・５／３Ａｌ２Ｏ３）系蛍光体が挙げられる。ＹＡＧ系蛍光体は、本発明においては、特に広義に解釈するものとしＹ、Ｌｕ、Ｓｃ、Ｌａ、Ｇｄ及びＳｍから選ばれた少なくとも１つの元素に置換し、あるいは、アルミニウムの一部あるいは全体を、ＧａとＩｎのいずれか又は両方で置換する蛍光作用を発する蛍光体を含む意味に使用する。このＹＡＧ系蛍光体は次のようにして得られる。まずＹ、Ｇｄ、Ｃｅの希土類元素を化学量論比で酸に溶解した溶解液をシュウ酸と反応させて共沈化合物を生成させ、この共沈化合物を焼成して共沈酸化物を得る。この共沈酸化物と酸化アルミニウムを混合して焼成して得られる焼成品を洗浄、分離、乾燥し、フルイを通してＹＡＧ系蛍光体を得ることができる。この蛍光体を利用して半導体素子からの光と蛍光体からの光の混色により白色系発光

（ＪＩＳ　Ｚ８１１０系統色名における、～みの白色を含む）を得ることもできる。

【００２９】同様に、青色系発光により赤色系が発光可能な蛍光体としては、Ｅｕ及び／またはＣｒで付活された窒素含有ＣａＯ－Ａｌ２Ｏ３－ＳｉＯ２蛍光体（オキシナイトライド蛍光硝子）が挙げられる。この蛍光体は、酸化アルミニウム、酸化イットリウム、窒化珪素及び酸化カルシウムなどの原料に希土類原料を所定比に混合した混合物を窒素雰囲気下で溶融して得られ、洗浄、分離、乾燥し、フルイを通して得ることができる。これにより、４５０ｎｍにピークをもった励起スペクトルと約６５０ｎｍにピークがある青色光により赤色発光可能なＥｕ及び／またはＣｒで付活されたＣａ－Ａｌ－Ｓｉ－Ｎ系オキシナイトライド蛍光硝子とすることができる。

【００３０】なお、Ｅｕ及び／またはＣｒで付活されたＣａ－Ａｌ－Ｓｉ－Ｎ系オキシナイトライド蛍光硝子の窒素含有量を増減することによって発光スペクトルのピークを５７５ｎｍから６９０ｎｍに連続的にシフトすることができる。同様に、励起スペクトルも連続的にシフトすることができる。そのため、Ｍｇ、Ｚｎなどの不純物がドープされたＧａＮやＩｎＧａＮを発光層に含む窒化ガリウム系化合物反動体からの光と約５８０ｎｍの蛍光体の光の合成により、ＹＡＧ系蛍光体と同様の白色系を発光させることができる。

【００３１】

【実施例】（実施例１）本発明の実施例１の発光装置は、実施の形態で用いた図１に示す導光体を用いた例である。この導光体の材料としてポリカーボネートを用い、導光体形成用の金型は、２つの側壁を有する三角柱状の切り欠きが７つ並んだものが２箇所に形成されるようにしてある。また、その金型は、導光体の第２の主面に発光される光の均一性を向上させるための凹凸（シボ）加工が施されるように作製される。導光体の成型は、まず、成型温度を２８０℃に設定してポリカーボネートを溶融させながら、射出圧力１０００ｋｇｆ／ｃｍ２、金型温度は１００℃で射出成型する。そして、４５秒間冷却した後、金型から取り出す。このようにして導光体を形成した。得られた導光体の一端面には三角柱状の切り欠きが５つ並んだものが２箇所に形成されており、５つの切り欠きの総幅はＬＥＤ素子とほぼ同じ幅になるように形成されている。各切り欠きは同じ幅であり、５つの切り欠きのうち中央に位置する切り欠きの中心がＬＥＤ素子の中心とほぼ対向している。中央の切り欠きは第１の面及び第２の面と光入射端面とのなす角度がともに約７５度であり発光面から見て二等辺三角形になっている。他の切り欠きはそれぞれ角度を変えた第１の面及び第２の面を有し、それぞれ中央から遠ざかるにしたがって第２の面（発光部の中央から遠い面）と光入射端面とのなす角度が８０度、８５度、９０度と変化し、第１の面（発光部の中央に近い面）と光入射端面とのなす角度は７０度、６５度、６０度と変化させてある。こうして得られた導光体には、導光体から面状に光を取り出す第１の主面及び導光体に光を導入させる端面を除いて反射シートを設置する。又、反射シートの設けられていない導光体の端面には、窒化物半導体からなるＬＥＤ素子２個を有し白色発光が可能なＳＭＤ型発光ダイオードを配置する。こうして得られた発光装置のＬＥＤ素子に電流を流すと、光が導光体の端面から入射され、導光体の第１の主面から面状に発光させることができる。形成された発光装置は、入射端面側の隅部及び光源間が他の部分と比べても発光輝度が劣ることなく均一に発光し、発光輝度も向上させることができる。

【００３２】（実施例２）導光体の材料としてアクリル樹脂を使用し、導光体端面に図４のような、第３の面を有する切り欠きが６つの切り欠きが２カ所に形成されるような金型を用い、成形温度を２５０℃、射出圧力１１００ｋｇｆ／ｃｍ２、金型温度８０℃、冷却時間は約３０秒で成型する以外は実施例１と同様に行い、本発明の発光装置を形成する。このようにして得られた発光装置において、ＬＥＤ素子に電流を流して面状発光させると、入射端面側の隅部及び光源間が他の部分と比べても発光輝度が劣ることなく均一に発光し、より均一な面状発光が得られる。

【００３３】（実施例３）導光体の材料としてアクリル樹脂を使用し、導光体端面に図５のような、曲面を介して第１の面と第２の面が接している７つの切り欠きが、２カ所に形成されるような金型を用い、成形温度を２５０℃、射出圧力１１００ｋｇｆ／ｃｍ２、金型温度８０℃、冷却時間は約３０秒で成型する以外は実施例１と同様に行い、本発明の発光装置を形成する。このようにして得られた発光装置において、ＬＥＤ素子に電流を流して面状発光させると、入射端面側の隅部及び光源間が他の部分と比べても発光輝度が劣ることなく均一に発光し、より均一な面状発光が得られる。

【００３４】（実施例４）導光体の材料としてアクリル樹脂を使用し、導光体端面に図６のような、６つの切り欠きがそれぞれ離れて形成されるた切り欠きが、２カ所に形成されるような金型を用い、成形温度を２５０℃、射出圧力１１００ｋｇｆ／ｃｍ２、金型温度８０℃、冷却時間は約３０秒で成型する以外は実施例１と同様に行い、本発明の発光装置を形成する。このようにして得られた発光装置において、ＬＥＤ素子に電流を流して面状発光させると、入射端面側の隅部及び光源間が他の部分と比べても発光輝度が劣ることなく均一に発光し、より均一な面状発光が得られる。

【００３５】（比較例１）同様に、比較例として導光体端面に図７のように、導光体端面に半円柱状の切り欠きを形成させる以外は実施例と同様にして発光装置を形成する。この発光装置において、ＬＥＤ素子に電流を流し

て面状に発光させたところ、ＬＥＤ素子周辺がやや明るく、また、入射端面側の隅部が暗くなっており、均一な面発光が得られなかった。又、その他の部分の発光輝度も充分ではなかった。

【００３６】

【発明の効果】以上説明したように、本発明の発光装置は、暗くなり易い入射端面側の隅部においても、他の部分と同程度の発光輝度を得ることができる。これによりＬＥＤ素子から放出されて導光体に入射する光を均一、かつ高輝度に導光体から放出させることができる。

【図面の簡単な説明】

【図１】　本発明の実施の形態に係る発光装置の模式的斜視図を示す。

【図２】　実施の形態の発光装置の模式的平面図を示す。

【図３】　（ａ）（ｂ）本発明の発光装置における導光体端面の切り欠きにおける光の屈折を説明するための模式的平面図を示す。

【図４】　本発明に係る変形例１の発光装置の導光体の模式的平面図を示す。

【図５】　本発明に係る変形例２の発光装置の導光体の模式的平面図を示す。

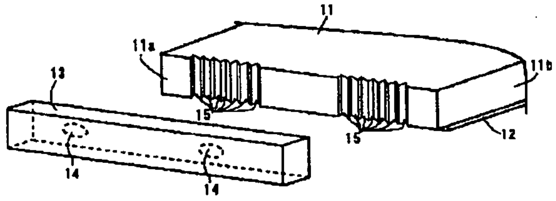
【図６】　本発明に係る変形例３の発光装置の導光体の模式的平面図を示す。

【図７】　比較例の発光装置の模式的平面図を示す。

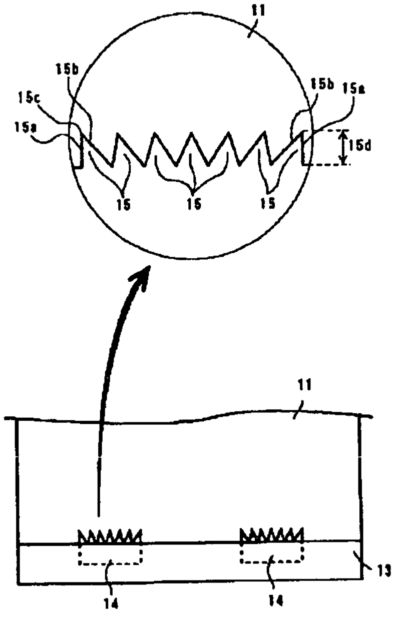
【符号の説明】

１１、７１・・・導光体
１１ａ・・・導光体の光入射端面
１１ｂ・・・導光体の側面
１２・・・反射体
１３、７３・・・ＬＥＤ素子
１４・・・光源
１５、３５、４１５、５１５、６１５、７５・・・切り欠き
１５ａ、３５ａ、４１５ａ、５１５ａ、６１５ａ・・・切り欠きの第１の面
１５ｂ、３５ｂ、４１５ｂ、５１５ｂ、６１５ｂ・・・切り欠きの第２の面
１５ｃ、３５ｃ・・・切り欠きの最深部
４１５ｅ・・・切り欠きの第３の面
５１５ｆ・・・切り欠きの曲面
６１１ｇ・・・導光体の光入射端面の平坦部

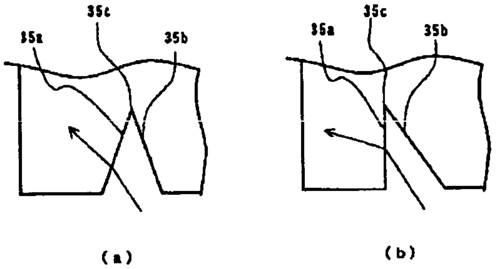
【図１】



【図２】

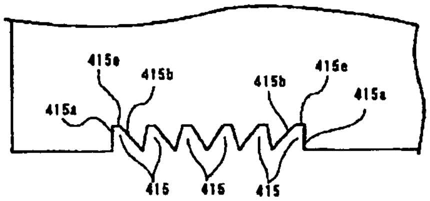


【図３】

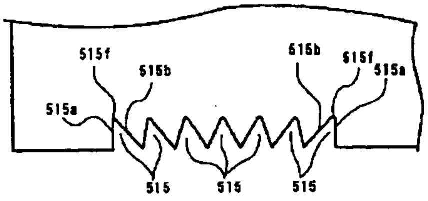


（ａ）　（ｂ）

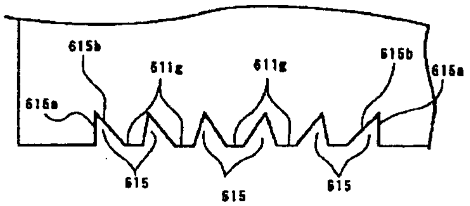
【図４】



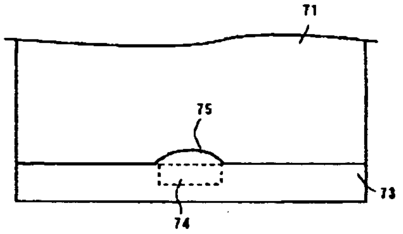
【図５】



【図6】



【図7】



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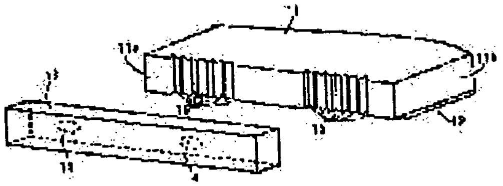
(54) LIGHT-EMITTING DEVICE

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a light-emitting device excellent in uniformity for bright luminance.

SOLUTION: A light-emitting device is provided which comprises, at least, a light guide comprising facing first and second surfaces, a reflector provided to the second main surface of the light guide, and a light source so provided as to face on one end surface of the light guide, with the light from the light source emitted from the first main surface of the light guide. The light guide comprises a plurality of notches, different in shape from each other, on one end surface facing the emerging surface of a light-emitting part of the light source. The plurality of notches comprise a first surface where an angle from one end surface of the light guide becomes larger as comes away from the center of a surface facing the light emerging surface of the light emitting part, and a second surface where the angle from one end surface of the light guide becomes smaller as comes away from the center of the surface facing the light emerging surface of the light-emitting part.



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[Date of final disposal for application]

[Patent number]

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[Date of requesting appeal against examiner's decision of rejection]

[Date of extinction of right]

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[JP,2002-042534,A]

CLAIMS

[Claim(s)]

[Claim 1] Luminescence equipment to which is equipped with the transparent material which has the 1st principal plane which counters at least and the 2nd principal plane which are characterized by providing the following, the reflector prepared in the 2nd principal plane of this transparent material, and the light source by which opposite arrangement was carried out in the end side of the aforementioned transparent material, and outgoing radiation of the light from this light source is carried out from the 1st principal plane of the aforementioned transparent material. It is the 1st field where the angle with the end side of the aforementioned transparent material to make becomes large as it keeps away from the center of the field where two or more of these notching counters with the outgoing radiation side of the aforementioned light-emitting part, respectively while the aforementioned transparent material has two or more notching of a configuration which is mutually different in the outgoing radiation side of the light-emitting part of the aforementioned light source, and the end side which counters. The 2nd field where the angle with the end side of the aforementioned transparent material to make becomes small as it keeps away from the center of the outgoing radiation side of a light-emitting part, and the field which counters.

[Claim 2] Luminescence equipment characterized by having two or more notching characterized by providing the following. The transparent material which has the 1st principal plane which counters at least, and the 2nd principal plane. The reflector prepared in the 2nd principal plane of this transparent material. It is the field where angles differ as it keeps away from the center of a light-emitting part to the end side where the aforementioned transparent material counters with the outgoing radiation side of the light-emitting part of the aforementioned light source in the luminescence equipment to which the end side of the aforementioned transparent material is equipped with the light source by which opposite arrangement was carried out, and outgoing radiation of the light from this light source is carried out from the 1st principal plane of the aforementioned transparent material.

[Claim 3] The aforementioned notching is luminescence equipment according to claim 1 or 2 from which it is separated of adjoining notching through the flat surface.

[Claim 4] The aforementioned light source is luminescence equipment according to claim 1 to 3 which absorbed the light from a semiconductor device and this semiconductor device, and is equipped with the fluorescent substance with which the light of long wavelength can emit light rather than the absorbed light.

[Claim 5] The aforementioned light source is luminescence equipment according to claim 1 to 3 which carries out outgoing radiation of the white light by the color mixture of the light which the aforementioned semiconductor device generates, and the light which the aforementioned fluorescent substance generates from the 1st principal plane of the above.

[Claim 6] It is luminescence equipment according to claim 4 or 5 which is one sort which the aforementioned semiconductor device is a nitride semiconductor device, and is chosen from nitrogen content CaO-aluminum2O3-SiO2 fluorescent substance activated by Y2O3.5 / 2O3aluminum3 fluorescent substance with which the aforementioned fluorescent substance was activated by Ce, Eu, and/or Cr.

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]
[The technical field to which invention belongs] As for this invention, it is possible to make light emit uniformly in respect of luminescence of a transparent material by which incidence is carried out from the Light Emitting Diode element which is the point light source, and it relates to the luminescence equipment used for a liquid crystal back light, a panel meter, an annunciator, a field luminescence switch, etc.

[0002]
[Description of the Prior Art] In recent years, the luminescence equipment which makes the light from the Light Emitting Diode element which is the point light source emit light in the shape of a field as the light sources, such as a liquid crystal back light, is used. This luminescence equipment is constituted so that outgoing radiation of the whole upper surface of the light guide plate of incidence Perilla frutescens (L.) Britton var. crispa (Thunb.) Decne. to the light may be carried out for the light from [from the optical incidence end face of a light guide plate] light emitting diode. In this luminescence equipment, it is important to output light to homogeneity from the upper surface (optical outgoing radiation side), and in order to realize this homogeneity, various structures are proposed. An example of such luminescence equipment is shown in the typical plan of drawing 7 . The luminescence equipment of drawing 7 has the reflecting plate (not shown) prepared in the side and the inferior surface of tongue except the luminous-radiation side and the optical incidence end face so that light might be made to emit to the optical incidence end face of the light guide plate 71 which consists of a penetrable resin, and its light guide plate from the Light Emitting Diode element [by which opposite arrangement was carried out] 74, and upper surface side of a light guide plate.

[0003] With the luminescence equipment of this drawing 7 , by forming the semicircle pilaster-like notching 75 in the optical incidence end face of a light guide plate, it constitutes so that light may distribute in the direction parallel to the upper surface of a light guide plate and incidence may be uniformly carried out to it, and the light by which incidence was carried out by this from the Light Emitting Diode element is attaining equalization of field luminescence by which outgoing radiation is carried out from the upper surface.

[0004]
[Problem(s) to be Solved by the Invention] However, in the present when homogeneity and high brightness luminescence are called for more, it is not enough. When a light emitting device with luminescence brightness high especially as the point light source (Light Emitting Diode element) was used, there was a problem that it was difficult for equalization of field luminescence and high brightness-ization to have the relation of a trade-off, and to make it compatible, only with above-mentioned composition. Then, this invention solves the above-mentioned problem, is more excellent in homogeneity, and aims at offering the luminescence equipment in which high brightness luminescence is possible.

[0005]
[Means for Solving the Problem] This invention persons diffused widely the light which carries out incidence from the end side of a transparent material by forming notching of a specific configuration in the end side of a transparent material by the inside of a transparent material as a result of various experiments, and it finds out that it is more uniform from a luminescence side, and it is possible to make high brightness emit light, and came to accomplish this invention.

[0006] Namely, the transparent material which has the 1st principal plane which the luminescence equipment of this invention counters at least, and the 2nd principal plane, In the luminescence equipment to which is equipped with the reflector prepared in the 2nd principal plane of a transparent material, and the light source by which opposite arrangement was carried out in the end side of a transparent material, and outgoing radiation of the light from the light source is carried out from the 1st principal plane of a transparent material a transparent material While having two or more notching of a configuration which is mutually different in the outgoing radiation side of the light-emitting part of the light source, and the end side which counters The 1st field where the angle with the end side of a transparent material to make becomes large as two or more notching keeps away from the center of the outgoing radiation side of a light-emitting part, and the field which counters, respectively, It is characterized by having the 2nd field where the angle with the end side of a transparent material to make becomes small as it keeps away from the center of the outgoing radiation side of a light-emitting part, and the field which counters. since the light which carries out incidence from the light source through notching formed in the end side of a transparent material by this can be made refracted in the direction according to the angle of the 2nd field of notching, and the 1st field, light is diffused more in the direction of latus — making — uniform — and — high — brightness field luminescence can be carried out

[0007] Moreover, the transparent material which has the 1st principal plane which the luminescence equipment of this invention counters at least, and the 2nd principal plane, In the luminescence equipment to which is equipped with the reflector prepared in the 2nd principal plane of a transparent material, and the light source by which opposite arrangement was carried out in the end side of a transparent material, and outgoing radiation of the light from the light source is carried out from the 1st principal plane of a transparent material a transparent material It is characterized by having two or more notching which has the field where angles differ as it keeps away from the center of a light-emitting part to the outgoing radiation side of the light-emitting part of the light source, and the end side which counters. Thereby, light can be made refracted in the direction according to the angle of the field which constitutes notching for the light from a light-emitting part.

[0008] Moreover, adjoining notching can leave notching mutually and can also make it form through a flat surface in this invention. If it does in this way, a flat side can be made to form between notching. Since the perpendicular direction of an incidence end face can be made to spread the light by which it is refracted in a longitudinal direction, it is made to diffuse the light by which incidence is carried out from the 1st field which constitutes notching among the light which carries out incidence to an optical incidence end face by this, and the 2nd field, and incidence is carried out from a flat side the luminescence equipment using the transparent material of a comparatively long configuration (for example, rectangle from which an optical incidence end face serves as a shorter side) — setting — uniform — and — high — brightness field luminescence can be carried out

[0009] Moreover, in this invention, a semiconductor device and the Light Emitting Diode element which absorbed the light from a semiconductor device and was equipped with the fluorescent substance with which the light of long wavelength can emit light rather than the absorbed light can be used for the light source. Thereby, outgoing radiation of the light of arbitrary wavelength can be carried out to the shape of a field with the combination of a semiconductor device and a fluorescent substance, and field luminescence which was excellent in color mixture nature (homogeneity of the luminescent color) with notching of an above-mentioned optical incidence end face can be obtained.

[0010] Moreover, in this invention, the light source can be constituted so that outgoing radiation of the white light by the color mixture of the light which a semiconductor device generates, and the light which a fluorescent substance generates may be carried out from the 1st principal plane of a transparent material. thereby, suitable for a liquid crystal back light etc. — uniform — high — brightness white system side luminescence can be obtained

[0011] Moreover, in the luminescence equipment of this invention, a semiconductor device can be made into a nitride semiconductor device, and let a fluorescent substance be the fluorescent substance chosen from nitrogen content CaO-aluminum2O3-SiO2 activated by

Y2O3.5/3aluminum2O3 activated by Ce, Eu, and/or Cr. Thereby, it can consider as the luminescence equipment in which reliable color mixture luminescence in high brightness is simple and possible.

[0012]
[Embodiments of the Invention] The luminescence equipment of this invention introduces into a transparent material the light emitted from the light source, and is made to emit light in the shape of a field. When the plate-like transparent material of an abbreviation rectangle is used when this luminescence equipment can choose the configuration of the transparent material used according to the use and purpose, for example, it uses for the back light of liquid crystal, such as a personal computer, and using for the back light of the panel meter of an automobile etc., the transparent material of a configuration according to the design is used. Hereafter, the luminescence equipment of the gestalt of operation concerning this invention is explained, referring to a drawing.

[0013] The luminescence equipment of the gestalt of operation of this invention is equipped with the transparent material 11 which has the 1st principal plane which counters at least, and the 2nd principal plane, the reflector 12 prepared in the 2nd principal plane of a transparent material, and the light source 14 by which opposite arrangement was carried out with the end side of a transparent material as shown in drawing 1 and drawing 2 . After the light emitted from the outgoing radiation side of the light-emitting part of the light source is introduced in a transparent material from optical incidence end-face 11a which is the end side of a transparent material, field luminescence of it is carried out from the 1st principal plane which is a luminescence side.

[0014] Here, especially the transparent material 11 of the luminescence equipment of the gestalt of this operation has two or more notching 15 of a configuration which is mutually different in the outgoing radiation side of the light-emitting part of the light source 14, and optical incidence end-face 11a which counters. 1st field 15a to which the angle with the optical incidence end face of the aforementioned transparent material to make becomes large as two or more of these notching 15 keeps away from the center of the outgoing radiation side of a light-emitting part, and the field which counters, respectively, It is characterized by having 2nd field 15b to which the angle with the optical incidence end face of the aforementioned transparent material to make becomes small as it keeps away from the center of the outgoing radiation side of a light-emitting part, and the field which counters. It can see from the luminescence side of a transparent material by this, the nonuniformity of the brightness near the optical incidence end face can be suppressed, and uniform field luminescence of high brightness can be carried out.

[0015] If it explains in detail, the light source 14 will consist of two Light Emitting Diode elements 13 allotted to the base material which consists of a resin organizer, and the crevice formed in the side in the luminescence equipment of the gestalt of this operation. The mould of this Light Emitting Diode element 13 is carried out with the translucency resin which allots a semiconductor device to the crevice of the resin package which has a lead electrode, and contains a fluorescent substance, and a mould is carried out so that the outgoing radiation side may become flat, as shown in drawing 2 .

[0016] In the gestalt of this operation, the transparent material 11 is fabricated by plate-like [of an abbreviation rectangle] with injection molding, using a translucency resin, and as shown in drawing 1 and drawing 2 , two or more notching 15 is formed in the light source 14 and the optical incidence end face which counters along with the longitudinal direction of an optical incidence end face. The light source 14 is equipped with two Light Emitting Diode elements 13, and two or more notching is formed in the field of the almost same width of face as the width of face of the light-emitting part of the Light Emitting Diode element 13, respectively. In the gestalt of this operation, one notching is the configuration of the shape of the triangle pole which consisted of two side attachment walls which reach the 2nd principal plane mostly from the 1st principal plane at a perpendicular. The side attachment wall of a side far from the center of the outgoing radiation side of a light-emitting part and the field which counters between two side attachment walls which constitute notching here is set to the 1st field 15a, and the side attachment wall of the side near a center is set to the 2nd field 15b. Although the width of face of each notching and a depth of 15d (distance of the optical incidence end face 14 and deepest section 15c) of the deepest section 15c (portion most deeply cut on the basis of the optical incidence end face) are almost the same, it is formed so that the positions of deepest section 15c may differ. As for the width of face of one notching, what is smaller than 1/3 of the width of face of a Light Emitting Diode element is desirable, and it is desirable to make it form small in the possible range according to the precision of metal mold etc. Moreover, since problems, like a thick air space will be prepared by the time the light from the light source will reach a transparent material if too not much deep although the depth of one notching can be made into the arbitrary depth, and become easy to lose light, and effective luminescence area becomes narrow depending on the gestalt of luminescence equipment may arise, it is necessary to take these into consideration.

[0017] Moreover, since deepest section 15c is formed so that it may come to the center of the width of face of notching, if notching located in the center among two or more notching formed in the outgoing radiation side of a light-emitting part and the field which counters is seen from a luminescence side, it will become an isosceles triangle. That is, the angle of the 2nd field and an optical incidence end face of the angle of the 1st field and an optical incidence end face to make to make is equal. Other notching is formed so that deepest section 15c may shift in the direction to leave as it separates from the center of the outgoing radiation side of a light-emitting part, respectively. By carrying out like this, the angle of the 1st field and the 2nd field, and the optical incidence end face which constitute notching to make is changed so that it may become greatly or small to an optical incidence end face, respectively. In addition, among notching which no configurations of notching needed to differ, respectively, for example, was located in a line seven, in the central configuration where three are the same, in three of centers, two of ends may be formed as configurations differ. When the number of a light-emitting part and notching which counters is even, it is not necessary to make isosceles triangle-like notching form, and the angle of the side attachment wall of notching is changed like the above with the position from the center of a light-emitting part.

[0018] In the luminescence equipment of the gestalt of this operation constituted as mentioned above, since two or more notching from which a configuration differs in the optical incidence end face of a transparent material is formed, it has the following operation effects. That is, incidence of the light by which outgoing radiation was carried out from the light source 14 is carried out to the notching 15 which has two side attachment walls (the 1st field 15a and 2nd field 15b) which reach the 2nd principal plane mostly at a perpendicular from the 1st principal plane formed in optical incidence end-face 11a of a transparent material 11. The light by which incidence was carried out to notching is introduced in a transparent material through the two above-mentioned fields, and is refracted or reflected at the angle according to the angle of the side attachment wall. For example, when incidence of the light which carries out incidence to 1st field 15a directly among the light from the light source is carried out to 1st field 15a with an incident angle (angle of the travelling direction of light, and the normal of a field to make) smaller than a total reflection angle, incidence of it is carried out into a transparent material with the angle of refraction according to the incident angle. Moreover, the light which carries out incidence to 1st field 15a with a larger incident angle than a total reflection angle is reflected towards 2nd field 15b, without being introduced in a transparent material. The light which carries out incidence with an incident angle smaller than a total reflection angle among the light reflected towards 2nd field 15b from the 1st field 15a is introduced in a transparent material from the 2nd field 15b. Moreover, as well as the above when the light from the light source carries out direct incidence to 2nd field 15b, it is reflected or refracted according to the incident angle to a side attachment wall. Here, although the physical relationship of the light source and notching is the same, refraction in case light carries out incidence to notching of the shape of the triangle pole from which a configuration differs (that is, the angles of a side attachment wall and an optical incidence end face to make differ) is shown in drawing 3 (a) and (b). It turns out that light is refracted more in the longitudinal direction (direction which tends toward the side of a transparent material here) by the angle of 1st field 35a and optical incidence end-face 31a in which light carries out incidence to make compared with drawing 3 (a) compared with drawing 3 (a) in the case of large drawing 3 (b). Since this changes an incident angle because the angle of a side attachment wall changes even if outgoing radiation of the light is carried out to the same angle from the light source, it is for the degree of angle of refraction also changing. Since light can be made by this refracted like drawing 3 (b), light can also make the low portion of luminescence brightness, such as between the light sources and a corner of a transparent material, able to spread, and uniform field luminescence of high brightness can be obtained. Moreover, since the distance between the light source and a side attachment wall becomes short compared with the same width of face and notching (a side attachment wall is a curved surface) of the shape of a pillar of the depth and an air space can be reduced, for example because the 1st field 35a and 2nd field 35b which constitute notching are a flat surface, loss of light can be lessened.

[0019] (Modification 1) Next, the modification of this invention is explained. The luminescence equipment of the modification 2 concerning this invention is constituted like the form of operation, except that two or more notching 415 which has 3rd field 415e is formed between the 1st field 415a and 2nd field 415b, as shown in drawing 4 . Since the angle of the 1st field of each notching and the 2nd field, and an optical incidence end face to make is changed like the form of operation, it diffuses the light from the light source widely in a longitudinal direction like the form of operation. The 3rd angle, width of face, etc. of field 415e (or you may add the 4th field etc. to this) can be made arbitrary, and it is not necessary to prepare them in all notching. Since the angle at which this 3rd field makes ** with an optical incidence end face compared with the 1st field and the 2nd field is small, distribution of the light to a direction distant from an optical incidence end face can be made [many].

[0020] (Modification 2) The luminescence equipment of the modification 2 concerning this invention is constituted like the gestalt of operation, except that two or more notching 515 which has 515f of curved surfaces is formed between 1st field 515a and 2nd field 515b, as shown in drawing 5 . Since the angle of the 1st field of each notching and the 2nd field, and an optical incidence end face to make is changed like the gestalt of operation, it diffuses the light from the light source widely in a longitudinal direction like the gestalt of operation. Ejection from metal mold in case it is narrow and the width of face of notching becomes [the width of face of the deepest section] thin can be made easy because the 1st field which carries out notching composition, and the 2nd field have touched through 515f of curved surfaces.

[0021] (Modification 3) The luminescence equipment of the modification 3 concerning this invention is constituted like the luminescence equipment of the gestalt of operation except the triangle pole-like notching 615 separating mutually and being formed, as shown in drawing 6 . The configuration of each notching 615 can be changed like the gestalt of operation. By the adjoining notching 615 separating and being formed, 611g (flat part) of perpendicular fields and the fields 615a and 615b which have an inclination to outgoing radiation light will be formed in an optical incidence end face to the outgoing radiation light from the light source. Although the side attachment walls 615a and 615b of notching 615 are refracted and can diffuse light widely in a longitudinal direction, 611g of flat parts can make light spread towards the opposite side of an optical incidence end face, without making an incident light r fracted in a longitudinal direction. Thus, with constituting, case [whose transparent material is / like the luminescence equipment using the comparatively long configuration (rectangle which uses an optical incidence end face as a shorter side)], even a portion far from an optical incidence end face can be made to spread light, and field luminescence of more uniform brightness is obtained. Although based comparatively (rate in the outgoing radiation side of a light-emitting part, and the field which counters) also on the configuration and size of a light guide plate as these notching 615 and 611g of flat sides, 1:2 to about 2:1 are desirable in terms of area. Moreover, the whole of each notching separates, it does not need to be formed, and some of them touch and may be formed.

[0022] As the gestalt of operation explained above, since the luminescence equipment of this invention can diffuse an incident light widely by the inside of a transparent material by changing the angle of two fields and optical incidence end faces which form in the optical incidence end face of a transparent material two or more notching from which a configuration differs, and constitute notching according to the position formed to make, it can suppress the nonuniformity of luminescence and can obtain field luminescence of high brightness.

[0023] As mentioned above, the luminescence equipment of this invention chooses the most suitable configuration for the configuration of notching according to the configuration of a transparent material, and it can constitute it so that an incident light can be diffused more effectively. in this case — although light can be diffused more intricately and the homogeneity of brightness can be raised, if the number of notching is increased and a side attachment wall is increased — metal mold — structure may become complicated and the problem of the configuration of the end face of the transparent material produced by the metal mold as a result stopping being fixed etc. may also be produced Therefore, it is desirable to choose the configuration which also takes manufacture conditions into consideration in addition to the requirement specification by the purpose of use, and is used.

[0024] That is, in this invention, since various configurations can be chosen, the restrictions on manufacture of a target performance and metal mold (manufacture precision and manufacturing cost), molding precision, etc. can be examined synthetically, and of which configuration notching is chosen can determine them.

[0025] Hereafter, a desirable material about each element in the luminescence equipment concerning this invention etc. is explained.
(Transparent material) It is desirable to use the thing excellent in light-transmission nature and the moldability as a material used for a transparent material in this invention, and acrylic resin, polycarbonate resin, cycloolefin polymer, polystyrene resin, a functional norbornene system resin, etc. are mentioned. Although refractive indexes differ, since the material for these transparent materials can control diffusion of light by selecting an angle, number, etc. of notching which are formed in the optical incidence end face of a transparent material, respectively, it can be equivalent to the material of any refractive indexes. The configuration of a transparent material can be made into arbitrary configurations according to a use.

[0026] (Light source) In the luminescence equipment of this invention, the light source is equipped with 1 or two or more Light Emitting Diode elements, in order to make it position and fix so that a Light Emitting Diode element and notching formed in the end side of a light guide plate may carry out opposite arrangement, is arranged so that the optical outgoing radiation side of a Light Emitting Diode element may counter the base material which consists of a resin Plastic solid with the optical incidence end face of a transparent material, and is constituted. The Light Emitting Diode element has the semiconductor device and the translucency resin which covers this, and a translucency resin can make the fluorescent substance which generates the light of wavelength which absorbs the light generated from a semiconductor device and is different from the absorbed light contain. When the light generated from a semiconductor device is ultraviolet rays, the fluorescent substance which is excited by these ultraviolet rays and generates ultraviolet rays or the light can be used, or the light from the semiconductor device which can emit light for the light, and this semiconductor device may be absorbed, and the fluorescent substance with which the light of long wavelength can emit light may be combined rather than it. That is, in this invention, it is possible by using a semiconductor device combining a fluorescent substance to make the mixed color of various color tones emit light. By carrying out incidence of the light, color mixture nature can also be improved from further above-mentioned notching.

[0027] (Semiconductor device) As a semiconductor device which can be used here, a nitride system compound semiconductor (a general formula IniGajAlkN however 0<=i, 0<=j, 0<=k, i+j+k=1) is mentioned, and there are various things including GaN by which InGaN and various impurities were doped. This semiconductor device is formed by growing up semiconductors, such as InGaN and GaN, as a luminous layer on a substrate by the MOCVD method etc. As structure of a semiconductor, the thing of gay structure with MIS junction, PIN junction, pn junction, etc., hetero structure, or double hetero structure is mentioned. This nitride semiconductor layer can choose various luminescence wavelength with the material and its degree of mixed crystal. Moreover, it can also consider as the single quantum well structure and abundant child well structure which formed the semiconductor barrier layer by the thin film which the quantum effect produces.

[0028] (Fluorescent substance) There is a photoluminescence fluorescent substance which is excited by the light or ultraviolet rays and emits light as an example of the fluorescent substance used for the luminescence equipment of this invention. As an example of a concrete photoluminescence fluorescent substance, YAG (Y2O3.5 / 3aluminum 2O3) system fluorescent substances, such as YAG:Ce which is the fluorescent substance with which a yellow system can emit light, are mentioned by blue system luminescence from nitride system compound semiconductor element. A YAG system fluorescent substance is used for the meaning containing the fluorescent substance which emits the fluorescence operation which replaces by at least one element which should interpret in the wide sense and was chosen from Y, Lu, Sc, La, Gd, and Sm, or replaces a part or the whole of aluminum by both Ga, and both [either or] especially in this invention. This YAG system fluorescent substance is obtained as follows. Make the solution which dissolved the rare earth elements of Y, Gd, and Ce in the acid by the stoichiometry first react with oxalic acid, a coprecipitation compound is made to generate, this coprecipitation compound is calcinated, and a coprecipitation oxide is obtained. The burned product which mixes this coprecipitation oxide and aluminum oxide, calcinates, and is obtained can be washed, and it can dissociate, and can dry, and a YAG system fluorescent substance can be obtained through a sieve. white system luminescence (the white in a JIS Z 8110-line color name to - see is included) can also be obtained using this fluorescent substance by the color mixture of the light from a semiconductor device, and the light from a fluorescent substance

[0029] Similarly, nitrogen content CaO-aluminum2O3-SiO2 fluorescent substance (oxy-night RAIDO fluorescence glass) activated by blue system luminescence by Eu and/or Cr as a fluorescent substance with which a red system can emit light is mentioned. The mixture which mixed the rare earth raw material at the predetermined ratio in raw materials, such as an aluminum oxide, a yttrium oxide, a silicon nitride, and a calcium oxide, can be fused under nitrogen-gas-atmosphere mind, this fluorescent substance is obtained, and it can wash, dissociate and dry and it can obtain it through a sieve. It can consider as the calcium-aluminum-Si-N system oxy-night RAIDO fluorescence glass activated by this by Eu and/or Cr in which red luminescence is possible by the excitation spectrum which had a peak in 450nm, and the blue glow which has a peak in about 650nm.

[0030] In addition, the peak of an emission spectrum can be continuously shifted from 575nm to 690nm by fluctuating the nitrogen content of the calcium-aluminum-Si-N system oxy-night RAIDO fluorescence glass activated by Eu and/or Cr. Similarly, an excitation spectrum can also be shifted continuously. Therefore, the same white system as a YAG system fluorescent substance can be made to emit light by composition of the light from a gallium-nitride system compound reactionary object, and the light of about 580nm fluorescent substance which contains in a luminous layer GaN by which impurities, such as Mg and Zn, were doped, and InGaN.

[0031]
[Example] (Example 1) The luminescence equipment of the example 1 of this invention is an example using the transparent material shown in drawing 1 used with the gestalt of operation. It is made to be formed at two places in that with which seven notching of the shape of the triangle

pole in which the metal mold for transparent material formation has two side attachment walls was located in a line, using a polycarbonate as a material of this transparent material. Moreover, the metal mold is produced so that concavo-convex (crimp) processing for raising the homogeneity of the light which emits light to the 2nd principal plane of a transparent material may be given. The injection molding of injection-pressure 1000 kgf/cm2 and the die temperature is carried out at 100 degrees C, setting molding temperature as 280 degrees C first, and molding of a transparent material carrying out melting of the polycarbonate. And after cooling for 45 seconds, it takes out from metal mold. Thus, the transparent material was formed. That to which five triangle pole-like notching was located in a line with the end side of the obtained transparent material is formed in two places, and the total width of face of five notching is formed so that it may become the almost same width of face as a Light Emitting Diode element. Each notching is the same width of face, and the center of notching located in the center among five notching has countered mostly with the center of a Light Emitting Diode element. The angle of the 1st field and the 2nd field, and an optical incidence end face to make is about 75 degrees, and both central notching is seen from a luminescence side, and has become an isosceles triangle. Other notching has the 1st field which changed the angle, and the 2nd field, respectively. The angle of the 2nd field (field distant from the center of a light-emitting part) and an optical incidence end face to make changes with 80 degrees, 85 degrees, and 90 degrees as it keeps away from a center, respectively, and the angle of the 1st field (field near the center of a light-emitting part) and an optical incidence end face to make is changed with 70 degrees, 65 degrees, and 60 degrees. In this way, except for the end face into which light is made to introduce, a reflective sheet is installed in the 1st principal plane and transparent material which take out light from a transparent material in the shape of a field at the obtained transparent material. Moreover, in the end face of the transparent material in which a reflective sheet is not prepared, it has two Light Emitting Diode elements which consist of nitride semiconductors, and the SMD type light emitting diode for which light can be emitted white is arranged to it. In this way, if current is passed for the Light Emitting Diode element of the obtained luminescence equipment, incidence of the light is carried out from the end face of a transparent material, and it can make light emit in the shape of a field from the 1st principal plane of a transparent material. The formed luminescence equipment can emit light uniformly, without luminescence brightness being inferior even if between the corner by the side of an incidence end face and the light source compares with other portions, and can also raise luminescence brightness.

[0032] (Example 2) Acrylic resin is used as a material of a transparent material, and notching which has the 3rd field like drawing 4 in a transparent material end face performs 250 degrees C, injection-pressure 1100 kgf/cm2, 80 degrees C of die temperatures, and a cooldown delay like an example 1 except casting molding temperature in about 30 seconds using metal mold with which six notching is formed in two places, and they form the luminescence equipment of this invention. Thus, in the obtained luminescence equipment, light is emitted uniformly, without luminescence brightness being inferior even if between the corner by the side of an incidence end face and the light source compares with other portions when current is made to pass and shape[of a field]-emit light for a Light Emitting Diode element, and more uniform field-like luminescence is obtained.

[0033] (Example 3) Acrylic resin is used as a material of a transparent material, and using metal mold which is formed in two places, except 250 degrees C, injection-pressure 1100 kgf/cm2, 80 degrees C of die temperatures, and a cooldown delay casting molding temperature in about 30 seconds, seven notching to which the 1st field and 2nd field are in contact with the transparent material end face through a curved surface like drawing 5 carries out like an example 1, and forms the luminescence equipment of this invention. Thus, in the obtained luminescence equipment, light is emitted uniformly, without luminescence brightness being inferior even if between the corner by the side of an incidence end face and the light source compares with other portions when current is made to pass and shape[of a field]-emit light for a Light Emitting Diode element, and more uniform field-like luminescence is obtained.

[0034] (Example 4) Acrylic resin is used as a material of a transparent material, and using metal mold which is formed in two places, except 250 degrees C, injection-pressure 1100 kgf/cm2, 80 degrees C of die temperatures, and a cooldown delay casting molding temperature in about 30 seconds, ********** which six notching like drawing 6 leaves to a transparent material end face, respectively and by which it is formed in it carries out like an example 1, and forms the luminescence equipment of this invention. Thus, in the obtained luminescence equipment, light is emitted uniformly, without luminescence brightness being inferior even if between the corner by the side of an incidence end face and the light source compares with other portions when current is made to pass and shape[of a field]-emit light for a Light Emitting Diode element, and more uniform field-like luminescence is obtained.

[0035] (Example 1 of comparison) Luminescence equipment is similarly formed in a transparent material end face like an example like drawing 7 as an example of comparison except making semicircle pillar-like notching form in a transparent material end face. In this luminescence equipment, when current was passed for the Light Emitting Diode element and light was made to emit in the shape of a field, it is a little bright in the Light Emitting Diode element circumference, and the corner by the side of an incidence end face is dark, and uniform field luminescence was not obtained. Moreover, the luminescence brightness of other portions was not enough, either.

[0036]
[Effect of the Invention] As explained above, the luminescence equipment of this invention can obtain luminescence brightness of the same grade as other portions also in the corner by the side of the incidence end face which is easy to become dark. The light which it is emitted by this from a Light Emitting Diode element, and carries out incidence to a transparent material can be made to emit to homogeneity and high brightness from a transparent material.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] The typical perspective diagram of the luminescence equipment concerning the gestalt of operation of this invention is shown.
[Drawing 2] The typical plan of the luminescence equipment of the gestalt of operation is shown.
[Drawing 3] (a) The typical plan for explaining the optical refraction in notching of the transparent material end face in the luminescence equipment of the (b) this invention is shown.
[Drawing 4] The typical plan of the transparent material of the luminescence equipment of the modification 1 concerning this invention is shown.
[Drawing 5] The typical plan of the transparent material of the luminescence equipment of the modification 2 concerning this invention is shown.
[Drawing 6] The typical plan of the transparent material of the luminescence equipment of the modification 3 concerning this invention is shown.
[Drawing 7] The typical plan of the luminescence equipment of the example of comparison is shown.
[Description of Notations]
11 71 ... Transparent material
11a ... Optical incidence end face of a transparent material
11b ... The side of a transparent material
12 ... Reflector
13 73 ... Light Emitting Diode element
14 ... Light source
15, 35, 415, 515, 615, 75 ... Notching
15a, 35a, 415a, 515a, 615a ... The 1st field of notching
15b, 35b, 415b, 515b, 615b ... The 2nd field of notching

15c, 35c ... The deepest section of notching
415e ... The 3rd field of notching
515f ... Curved surface of notching
611g ... Flat part of the optical incidence end face of a transparent material

* NOTICES *

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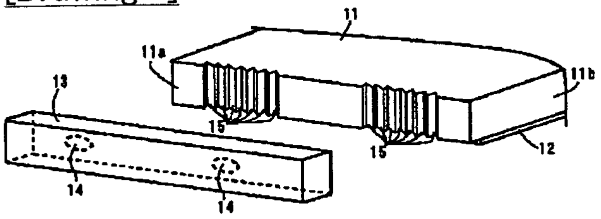
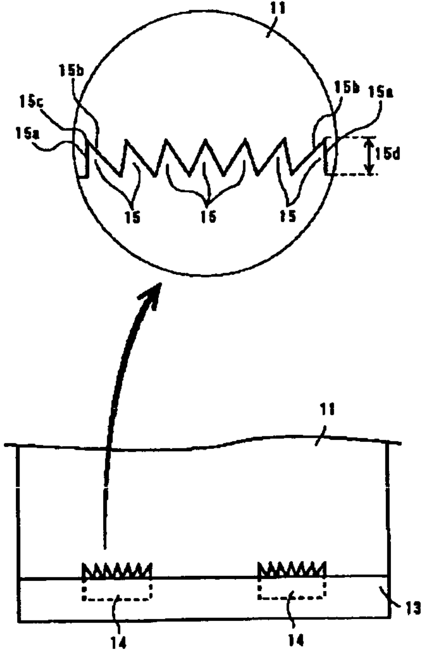
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

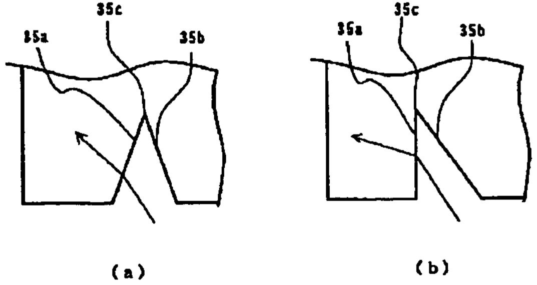
[Drawing 1]



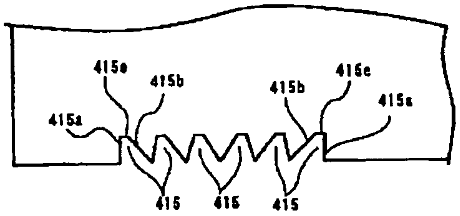
[Drawing 2]



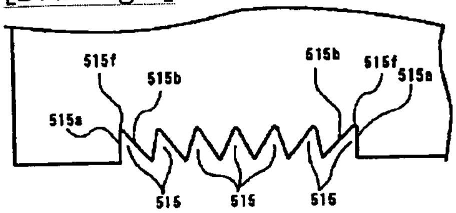
[Drawing 3]



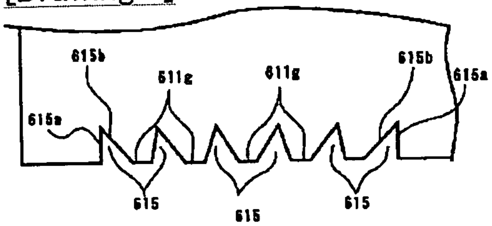
[Drawing 4]



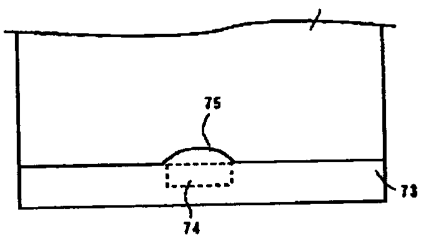
[Drawing 5]



[Drawing 6]



[Drawing 7]



[Translation done.]